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Computational Particle-Based Methods in Mining and Mineral Processing

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ABSTRACT

Mining and mineral processing involve a wide range of processes spanning multiple length and time scales and involving complex interactions between particles, fluids, and structures. Examples include fragmentation, particle breakage, crushing and grinding, drilling and excavation, flotation and material transport and handling. These processes are often governed by coupled multi-physics phenomena and exhibit strongly heterogeneous behaviour, making their analysis and optimization particularly challenging.

Particle-based computational methods have emerged as powerful tools for understanding, designing, and optimizing mining and mineral processing systems. Advances in computational power, coupled with the growing availability of high-performance computing resources, have enabled increasingly realistic simulations of particulate processes, providing insights into equipment design, process performance, and energy efficiency. However, there remain significant challenges in areas such as particle breakage modelling, multiphase flow, multiscale simulations, model calibration and validation.

This session aims to highlight recent developments and future challenges in computational particle-based methods for mining and mineral processing. Topics include, but are not limited to, particle breakage and fragmentation modelling, multi-physics and multiscale simulations, particle-fluid and particle-structure interactions, as well as applications in comminution, crushing and grinding, flotation, drilling and excavation, transport and handling of granular materials, and related processes. We invite both pure methodological developments and novel process simulations, demonstrating the capabilities of discrete and continuum approaches.